UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/619,634	07/15/2003	Russell L. Lewis	TUC 920030028 US1 (16472)	1229

46263	7590	10/17/2006

SCULLY, SCOTT, MURPHY, & PRESSER
400 GARDEN CITY PL
GARDEN CITY, NY 11530

EXAMINER
DARNO, PATRICK A

ART UNIT	PAPER NUMBER
2163	

DATE MAILED: 10/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/619,634	LEWIS, RUSSELL L.
	Examiner	Art Unit
	Patrick A. Darno	2163

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>11 September 2006</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-20</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-20</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>15 July 2003</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All   b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date _____.

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 18-20 are new. Claims 1, 16, and 17 have been amended. Claims 3-5 and 14

were previously presented. Claims 2, 6-13, and 15 are in their original form. Claims 1-20 are

pending in this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2.   Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for

failing to particularly point out and distinctly claim the subject matter which applicant regards as

the invention.

With respect to claim 1, the preamble of the claim recites "A garbage collecting method

for a memory resource in a computer system...". However, the claimed invention never actually

collects garbage. It appears that the claimed invention simply determines whether or not a

particular object is garbage. Therefore, the preamble appears to be misleading, which results in

making the claim indefinite. The act of determining if an object is garbage is indeed useful, but

as the claim stands the preamble does not reflect what actually occurs in the method steps.

In order to overcome this rejection, the Applicant is required to modify the preamble of

all independent claims. A fitting preamble would read, "A method for determining if an object

stored in memory is garbage, comprising...".

Claims 2-20 are rejected because they either contain or inherit the deficiencies of claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3.   Claims 1-3, 6, 8-9, 12-13, and 16-20 are rejected under 35 U.S.C. 102(e) as being

anticipated by non-patent literature titled "Diffusion Tree Restructuring for Indirect Reference

Counting" issued to Dr. Peter Dickman (hereinafter "Dickman").

<u>**Claim 1:**</u>

Dickman discloses a garbage collecting method for a memory resource in a computer

system, comprising:

for each of a plurality of objects in the memory resource, maintaining a reference count

based on a number of objects pointing thereto *(Dickman: page 2, column 1, lines 9-14)*, and

maintaining a depth value based on a distance from a global data object in a reference chain

(Dickman: page 6, column 2, lines 18-20), the step of maintaining a depth value further including at

least keeping an existing depth value associated with an object when a new link is added from

another object to the object if the existing depth value associated with the object is a valid depth

value *(Dickman: page 6, column 2, lines 18-20 and page 6, column 2, lines 18-20; The references clearly show*

maintaining a depth value and keeping a current depth value after a new link is created.);

identifying, based on the associated reference count and depth value, which of the

plurality of objects are processed to determine whether or not they are garbage *(Dickman: page 9,*

column 1, lines 48-55 and page 9, column 2, lines 8-14; Dickman's invention clearly discloses the use of a reference

count and depth value in order to determine if an item is garbage, which aids the computer in actually collecting the

garbage.);

wherein each of the plurality of objects can be pointed to by one or more other objects

and wherein each of the plurality of objects can be part of, and have different positions in,

different reference chains such that the reference count and depth value change as the other

objects that point to each of the plurality of objects change *(Dickman: page 2, column 1, lines 9-14 and*

page 6, column 2, lines 18-20; The Applicant's claimed invention simply recites reference counting garbage

collecting with the addition of a depth counter. Reference counting garbage collection is well known in the art. And

note that the Dickman reference clearly discloses maintaining both a reference count and depth value to aid in the

collection of garbage.).

Claim 2:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further

discloses wherein:

for each object, the depth value is maintained by providing a depth value in metadata

associated with the object *(Dickman: page 6, column 2, lines 22-24; The Dickman reference clearly points out*

that a depth value is annotated for each object. No matter where the depth value is stored, it must be stored in some

form of metadata because the depth value is itself metadata. The depth value is data about the object data. So where

the depth value is stored it must be stored with metadata because the depth value itself is metadata.).

Claim 3:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further

discloses wherein:

a first of the objects is identified for processing when it is determined that a second of the objects previously pointing thereto is no longer pointing thereto *(Dickman: page 2, column 1, lines 17-19)*, and the depth value of the second object is one less that the depth value of the first object *(Dickman: page 6, column 2, lines 18-20)*.

Claim 6:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further discloses wherein:

the distance for each of the plurality of objects is based on a number of objects linking the each of the plurality of objects to the global data object *(Dickman: page 6, column 2, lines 18-20 and Fig. 8i)*.

Claim 8:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further discloses method comprising:

initializing the depth value of a new object created at runtime to one or more than the depth value of an object that points to the new object and links the new object to the global data object *(Dickman: page 6, column 2, lines 18-20)*.

Claim 9:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further discloses wherein:

when a particular one of the objects that is processed is determined to be garbage, its associated portion of the memory resource is made available for re-allocation *(Dickman: page 2, column 1, lines 17-19; When memory is re-claimed in by a garbage collection process, it is re-allocated.)*.

Claim 12:

Dickman discloses all the elements of claim 10, as noted above, and Dickman further

discloses wherein:

the particular object is determined to be non-garbage when it is accessible to outside

objects *(Dickman: page 2, column 1, lines 17-19; An object is only determined to be garbage when it is not*

accessible to outside objects through reference pointers. Therefore, if the object is accessible to outside objects

through reference pointers, then the object is not garbage.).

Claim 13:

Dickman discloses all the elements of claim 1, as noted above, and Dickman further

discloses wherein:

when a new link is created from a first object of the plurality of objects to a second object

of the plurality of objects, and the first object has a valid depth value but the second object does

not have a valid depth value, the depth value of the second object is initialized to one more than

the depth value of the first object *(Dickman: page 6, column 2, lines 18-20).*

Claim 16:

Claim 16 is a computer program product claim corresponding to method claim 1 and is

rejected under the same reasons set forth in the rejection of claim 1.

Claim 17:

Claim 17 is a computer system claim corresponding to method claim 1 and is rejected

under the same reasons set forth in the rejection of claim 1.

Claim 18:

Dickman discloses all the elements of claim 1, and Dickman further discloses wherein the

depth value ranges from a first value to a predetermined maximum value and when a depth value

associated with a first object reaches the predetermined maximum value, a depth value

associated with a second object that links from the first object is wrapped around to the first

value *(Dickman: page 2, column 1, lines 45-51)*.

Claim 19:

.Claim 19 is rejected under the same reasons set forth in the rejection of claim 18.

Claim 20:

Claim 20 is rejected under the same reasons set forth in the rejection of claim 18.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

4.   Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dickman and

further in view of the admitted prior art of U.S. Patent Application Publication Number

2002/0087590 issued to David Francis Bacon et al. (hereinafter "Bacon Prior Art").

Claim 4:

Dickman discloses all the elements of claim 3, as noted above. The Examiner believes

that all elements of claim 4 are implicitly disclosed in the Dickman reference because the

Dickman reference clearly teaches reference counting garbage collection. But, the Dickman reference does not explicitly disclose wherein: the second object is no longer pointing to the first object because the second object was destroyed.

However, Bacon Prior Art discloses wherein: the second object is no longer pointing to the first object because the second object was destroyed *(Bacon Prior Art: paragraph [0013], lines 9-12; This reference shows a node being removed (destroyed). A node that is removed (destroyed) can no longer point to any other objects. It is obvious, and possibly inherent, that if the second object is destroyed that it is no longer point to a first object.).* It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Dickman with the teachings of Bacon Prior Art noted above. The skilled artisan would have been motivated to improve the teachings of Dickman per the above such that a system will easily recognize that a given subgraph is garbage *(Bacon Prior Art: paragraph [0013], lines 9-12).*

Claim 5:

Dickman discloses all the elements of claim 3, as noted above. The Examiner believes that all elements of claim 5 are implicitly disclosed in the Dickman reference because the Dickman reference clearly teaches reference counting garbage collection. But the Dickman reference fails to explicitly disclose wherein the second object is no longer pointing to the first object because the second object was reset to point to another.

However, Bacon Prior Art discloses wherein the second object is no longer pointing to the first object because the second object was reset to point to another *(Bacon Prior Art: paragraph [0012], lines 1-4; This reference shows tracking a reference count for an object. As a computer program executes, pointers are setting and resetting constantly to reflect changes in the program. It is just a matter of time before a*

given object will no longer point to another object. The reference counting algorithm disclosed by Bacon Prior Art

then identifies an item as garbage when no more reference pointers point to a particular object). It would have

been obvious to one of ordinary skill in the art at the time the invention was made to modify the

teachings of Dickman with the teachings of Bacon Prior Art noted above. The skilled artisan

would have been motivated to improve the teachings of Dickman per the above such that a

reference count for each node is efficiently tracked upon the changing of an object reference

pointer *(Bacon Prior Art: paragraph [0012], lines 1-4).*

5.   Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dickman and

further in view of U.S. Patent Application Publication Number 2002/0087590 issued to David

Francis Bacon et al. (hereinafter "Bacon").

Claim 7:

Dickman discloses all the elements of claim 6, as noted above, and But Dickman does not

explicitly disclose wherein: the objects processed to determine whether or not they are garbage

are processed by a loop detection mechanism for a reference counting garbage collector.

However, Bacon discloses wherein: the objects processed to determine whether or not

they are garbage are processed by a loop detection mechanism for a reference counting garbage

collector *(Bacon: paragraph [0019], lines 1-5).* It would have been obvious to one of ordinary skill in

the art at the time the invention was made to modify the teachings of Dickman with the teachings

of Bacon noted above. The skilled artisan would have been motivated to improve the teachings

of Dickman per the above such that cycles in a reference counting garbage collecting method

could be detected *(Bacon: paragraph [0019], lines 1-5).*

6.   Claims 10-11 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Dickman and further in view of U.S. Patent Number 6,338,159 issued to William Preston

Alexander, III et al. (hereinafter "Alexander").

Claim 10:

Dickman discloses all the elements of claim 1, as noted above, but Dickman does not

explicitly dislcose wherein: when a particular one of the objects that is processed is determined

to be non-garbage, its depth value, and the depth values of other ones of the objects that are

pointed to by the particular object and linked to the global data object thereby, are reset.

However, Alexander discloses wherein: when a particular one of the objects that is

processed is determined to be non-garbage, its depth value, and the depth values of other ones of

the objects that are pointed to by the particular object and linked to the global data object

thereby, are reset *(Alexander: column 5, lines 24-27 and Fig. 5; By resetting the depth (level) value of the root*

object in Fig. 5, the depth value of all the objects pointed to by that object would also reset. This is because the root

would initialize to zero and the nodes the root points to will have a level (or depth) value that counts up from zero.).

It would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify the teachings of Dickman with the teachings of Alexander noted above. The skilled

artisan would have been motivated to improve the teachings of Dickman per the above such that

the level (or depth) value generated by tracing could be used in the memory allocation and

deallocation process *(Alexander: column 2, lines 42-43).*

Claim 11:

The combination of Dickman and Alexander discloses all the elements of claim 10, as

noted above, and Alexander further discloses wherein:

the depth values of objects that are pointed to by the other ones of the objects whose

depth values are reset, and linked to the global data object thereby, are also reset *(Alexander:*

column 5, lines 24-27 and Fig. 5; Claim 11 is rejected under the same reasons set forth in claim 10.).

Claim 14:

Dickman discloses all the elements of claim 1, as noted above. The Examiner believes

that all elements of claim 14 are implicitly disclosed in the Dickman reference because the

Dickman reference clearly teaches a reference counting garbage collection algorithm, which

maintains depth values. These depth values would have to have some initial value. But, the

Dickman reference does not explicitly disclose a method, which comprises initializing a depth

value of the global object to a valid depth value.

However, Alexander discloses a method, which comprises initializing a depth value of

the global object to a valid depth value *(Alexander: column 5, lines 24-27 and Fig. 5; Both of these*

references display initializing the global object (root) to a depth (level) of zero.). It would have been obvious

to one of ordinary skill in the art at the time the invention was made to modify the teachings of

Dickman with the teachings of Alexander noted above. The skilled artisan would have been

motivated to improve the teachings of Dickman per the above such that the level (or depth) value

generated by tracing could be used in the memory allocation and deallocation process *(Alexander:*

column 2, lines 42-43).

Claim 15:

Dickman discloses all the elements of claim 1, as noted above, but Dickman does not

explicitly disclose a method, which comprises initializing depth values of the plurality of objects

to a specified value.

However, Alexander discloses a method, which comprises initializing depth

values of the plurality of objects to a specified value *(Alexander: column 5, lines 24-27 and Fig. 5; These*

references show that the depth value of objects are initialized to one more than the depth value of the object linked to

it.). It would have been obvious to one of ordinary skill in the art at the time the invention was

made to modify the teachings of Dickman with the teachings of Alexander noted above. The

skilled artisan would have been motivated to improve the teachings of Dickman per the above

such that the level (or depth) value generated by tracing could be used in the memory allocation

and deallocation process *(Alexander: column 2, lines 42-43).*

Response to Arguments

Examiner Notes:

In light of the new grounds of rejection set forth in this Office Action, some arguments

set forth by the Applicant are rendered moot. Those arguments rendered moot due to the new

grounds of rejection are not discussed below.

Applicant Argues:

Independent claims 1, 16, and 17 now recite "maintaining a depth value further including at least
keeping an existing depth value associated with an object when a new link is added form another object to
the object if the existing depth value associated with the object is a valid depth value."

Examiner Responds:

Examiner is not persuaded. The Examiner has introduced new grounds of rejection for claims 1,

16, and 17. However, the Examiner does not concede that the Alexander reference does not disclose the

above limitation. The Examiner introduced new grounds of rejection simply because the Examiner

discovered a reference which qualifies under 35 U.S.C. 102. The Alexander reference still discloses the

above limitation because the depth value would be 'kept' as long as the objects distance from the root is

not changed. Or, in other words, unless an object is moved further from, or closer to, the root object, the

depth value remains unchanged or is kept. Therefore, the Examiner believes that given the proper

interpretation due to a rejection under 35 U.S.C. 103(a), the combination of Bacon Prior Art and

Alexander still discloses all the elements of claims 1, 16, and 17. However, the rejection was modified due

to the Examiner discovering a reference under 35 U.S.C. 102 while performing a further, updated search.

Applicant Argues:

Further because Alexander's tree level values are different from "a depth value" of the present
application at least as explained in the previous responses, Alexander does not disclose, suggest, or teach
that this "depth value" can be kept "when a new link is added from another object to the object if the
existing depth value associated with the object is a valid depth value."

Examiner Responds:

Examiner is not persuaded. The Examiner believes that the 'tree level values' disclosed

in the Alexander reference and the 'depth values' disclosed in the Applicant's claimed invention

are at the very least analogous. Both values simply represent a distance from the root object in a

tree like structure. The Examiner maintains that the maintenance and manipulation of such a

value would have been obvious to one of ordinary skill in the art at the time the invention was

made.

Contact Information

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Patrick A. Darno whose telephone number is (571) 272-0788.

The examiner can normally be reached on Monday - Friday, 10:00 am - 6:30 pm.
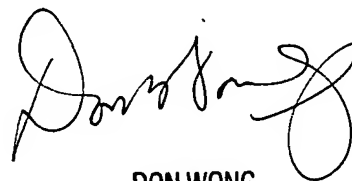
If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Don Wong can be reached on (571) 272-1834. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would

like assistance from a USPTO Customer Service Representative or access to the automated

information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Patrick A. Darno
Examiner
Art Unit 2163

PAD

DON WONG
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100